

The following pages are reproduced from the *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*, Baltimore, Maryland, January 1989.

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Evaluation of Prehistoric Site Preservation on the Outer Continental Shelf: The Sabine River Area, Offshore Texas and Louisiana

Introduction

For the past decade there has been an increasing interest in the prehistoric archaeological potential of the continental shelves of the world. Prior to about 10,000 years ago, because of lower sea levels, vast areas of the North American continental shelf were exposed, providing land and resources to aboriginal populations. There is no doubt that these populations used and settled these areas. Today, many would agree that, given certain conditions, prehistoric sites established on the continental shelf during those periods of lowered sea level would have withstood the effects of rising seas and would now remain preserved on the submerged portions of the shelf. One of the settings that could provide the conditions leading to site preservation on the continental shelf is a filled stream valley. This is particularly true of the larger valleys which, with sea level rise, develop into estuaries and slowly fill with sediments before being completely inundated. Archaeological deposits can become covered by and encapsulated in estuarine sediments and remain intact beneath the erosive impacts of rising seas. Developing statements concerning the potential occurrence and distribution of archaeological deposits in these offshore settings requires the projection of a culture history for the area with its attendant settlement patterns probably best drawn from onshore analogies; an assessment of the geological and ecological history of the area, and the identification of the geomorphological processes which affect archaeological site preservation.

To date, several studies relying on these types of data have produced what appear to be reasonable models of site occurrence and preservation in large stream valleys on the North American continental shelf (Belknap and Kraft 1981; Coastal Environments, Inc. 1977; Kraft et al. 1983; Masters and Fleming 1983). Testing these models, however, is a more complicated problem. It requires a technology that permits the identification of submerged and buried landforms which have a high likelihood of containing cultural remains, and it also requires a method for collecting samples from these landforms. In essence, it demands a practical geological/geophysical approach to an archaeological problem. Fortunately, this technology is available today in the form of a variety of instruments that enable refined mapping of the shallow subsurface geology of the continental shelf and in a range of coring devices which can collect a physical sample suitable for analysis for a submerged target landform.

In 1985 and 1986, Coastal Environments, Inc. undertook a study which had the specific objective of locating buried archaeological deposits in a filled stream valley setting in the

Sabine-High Island area on the outer Continental Shelf (OCS) of the Gulf of Mexico (Pearson et al. 1986). The project, sponsored by the Minerals Management Service of the Department of the Interior, was designed as a test of a model of site occurrence and preservation developed in an earlier study of the cultural resources potential of the OCS (Coastal Environments, Inc. 1977). In addition, the study provided an opportunity to evaluate the usefulness of various technologies in this type of research. The project was conducted in two phases. The first phase involved the synthesis and evaluation of previously collected archaeological, geological, seismic, and bore hole data from the study area. The second phase of the study involved the field collection of additional seismic data and the taking of core samples from several offshore target areas which had been identified as potential archaeological site locales.

The region selected for implementation of this study is a 35-mi-square area in the offshore Sabine-High Island region of eastern Texas and western Louisiana (Figure 1). Submerged and buried in this area are the relict and filled channels of the late-Pleistocene-to-Holocene age Sabine River Valley. Prior to its inundation by rising seas about 7000 years ago, the Sabine River extended its course across this section of the continental shelf. Figure 1 depicts the estimated configuration of the filled river valley and shows several areas ("lease blocks") which received intensive survey coverage during our study. This river system provided an ideal research universe for several reasons. An abundance of published and unpublished data is available that provides information on the present setting and geological history of the offshore river system. Of particular importance is the published work of Nelson and Bray (1970) that delineates the Pleistocene river system and the subsequent changes it underwent with sea level rise. In addition, an extensive body of seismic and borehole data, collected relative to oil industry activities, is available about the area, and the regional geology has been well studied (Aronow 1971; Aten 1983; Bernard 1950; Bernard and LeBlanc 1965; Bernard et al. 1962; Berryhill 1980; Curray 1960; Nelson 1968).

Other factors which make the offshore Sabine Valley conducive in the search for submerged sites are: (1) the river system was active and the region was exposed as dry land when prehistoric populations occupied the region; (2) the river system was active for at least 12,000 years, sufficient time to permit the accumulation of an extensive archaeological record; (3) relict features having a high probability for both site occurrence and preservation have been identified within the valley system; and, (4) these landforms are often not deeply buried and many are within the range of standard coring techniques.

Field Techniques

During the course of the study, data from over 100 offshore lease block surveys, 23 pipeline right-of-way surveys and 35 borings were examined. An extensive amount of additional seismic data was collected in eight lease blocks within the study area in an attempt to locate and accurately map landforms on which archaeological sites may occur. Additionally 77 cores were taken at five selected "high probability" locales. These were locales presumed most likely to contain preserved archaeological deposits as derived from a model of site-landform relationships and on presumptions about the degree of preservation of the landform. Sediment samples from the cores were analyzed in order to further refine the local geology and to test for the presence of cultural remains.

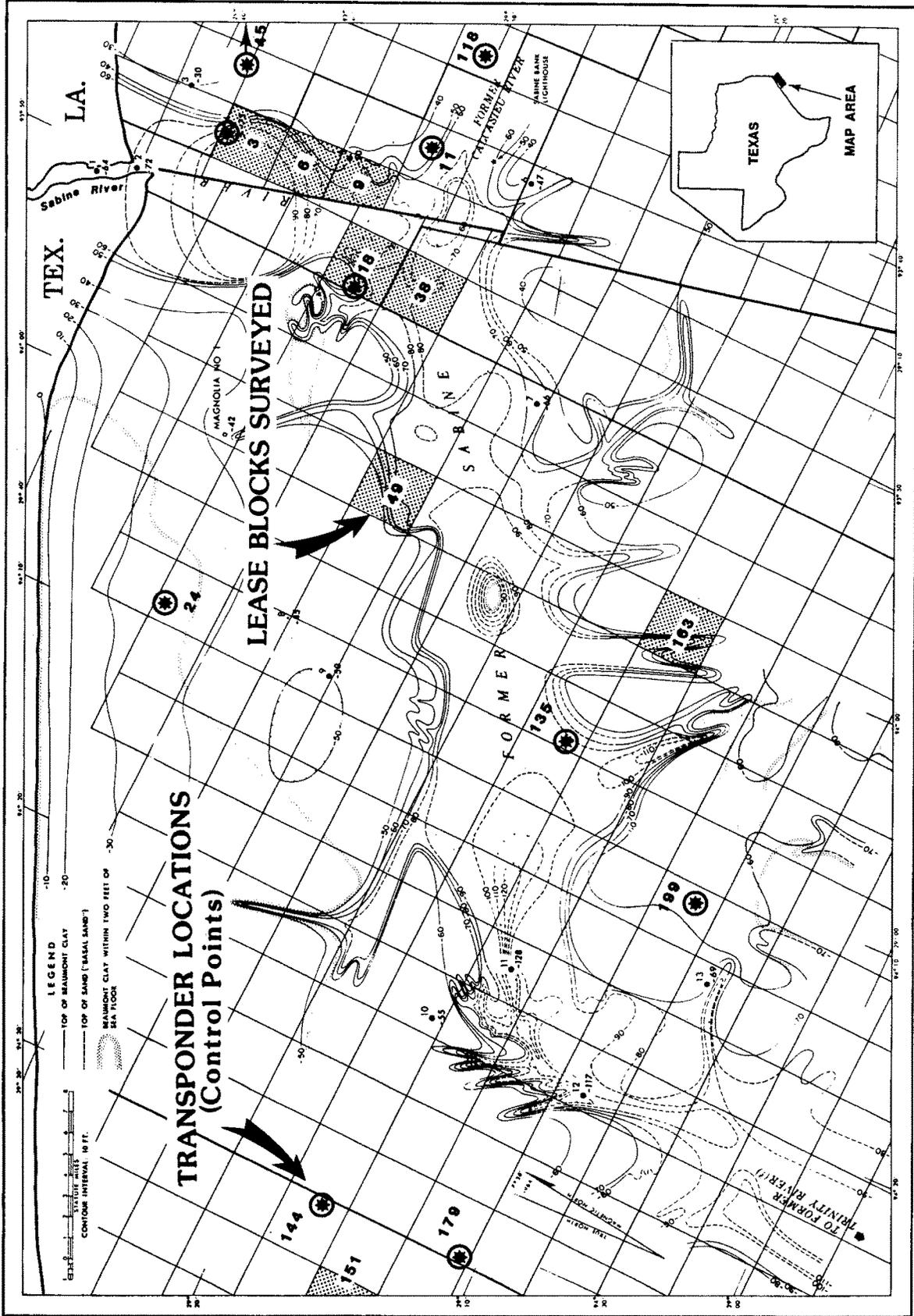


FIGURE 1. The study area showing filled and submerged Sabine River Valley (Nelson and Bray 1970). Also shown are the lease blocks which were intensively surveyed and the survey control points.

Seismic data were collected with an ORE Subbottom Profiler, commonly known as a pinger, operating at a frequency of 3.5 KHz. In most cases, the pinger provided high resolution records of the upper 40 ft or so of the sea floor. Once the seismic data were analyzed, the high probability locales were selected for coring. The coring device used is known as a "vibracore," an instrument with a vibrating boring tube which can extract continuous cores with a 4-in diameter up to 40 ft in length.

Results

The analysis of all of the collected seismic and core data has provided information on the geological history of the study area and its archaeological potential. In most respects, our findings correspond closely to those developed earlier by Nelson and Bray relative to the configuration and age of the offshore

Sabine River Valley. A major departure from Nelson and Bray is our identification of extensive areas of relict Deweyville floodplain within the offshore Sabine Valley. A distinguishing characteristic of Deweyville landforms is the presence of "giant" meander scars three to six times larger than modern channels (Bernard 1950; Gagliano and Thom 1967; Saucier 1974).

The Deweyville channels identified in our study area are 900 to 1000 ft across, comparable in size to relict Deweyville channels seen today along the on-shore Sabine River. It is recognized that Deweyville channels reflect much higher discharges than at present; however, there is disagreement over the nature and conditions responsible for the increased discharge as well as the age of the Deweyville features (Alford and Holmes 1985). Radiocarbon assays on wood from relict Deweyville channels onshore indicate an age ranging from 17,000 to greater than 30,000 years B.P. (Bernard and LeBlanc 1965). Some, however, argue that the conditions responsible for Deweyville allu-

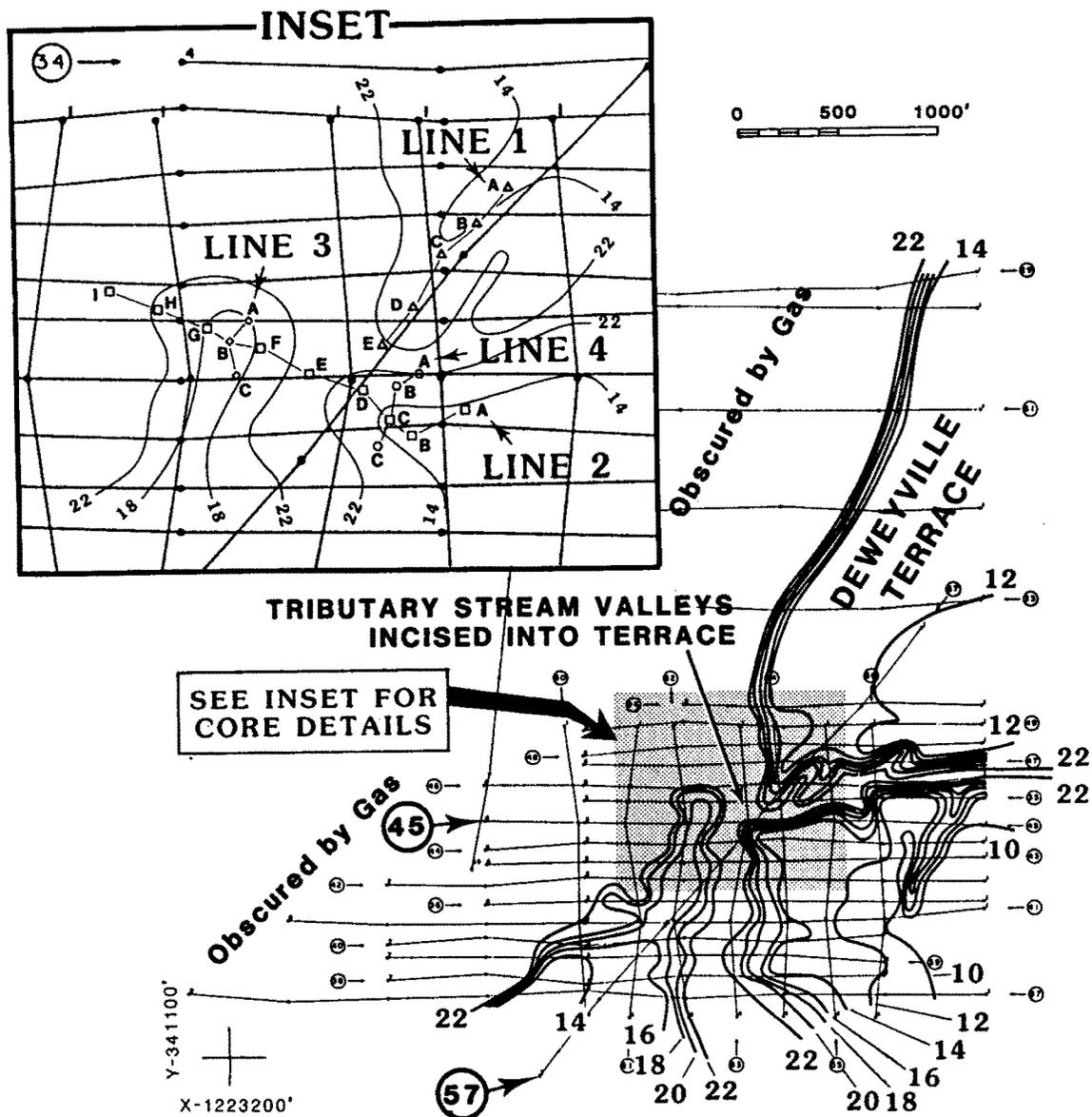


FIGURE 2. Plan view of features identified from seismic records in Lease Block 6. Contours are in ft below the present seafloor.

viation continued up to 6000 or 7000 years ago (Alford and Holmes 1985; Gagliano and Thom 1967). A lack of radiocarbon dates has been one of the reasons behind the controversy over the dating of the Deweyville. Fortunately, within our study area we were able to obtain several radiocarbon dates from swamp deposits capping Deweyville channel features. The earliest of these is 10,145 +/- 285 B.P. (UGa-5402), indicating that Deweyville channels in the study area are somewhat older than that date. Critical to the present study is the fact that early human occupation on this section of the continental shelf was very likely associated with Deweyville landforms. The climatic conditions producing the giant streams and the environmental setting of the Sabine River Valley during Deweyville times must have been quite different from those of today. How the region's early hunters adapted to this environment is not yet understood.

The identified Deweyville surfaces in the study area fringe both sides of the Sabine Valley and exist as a topographically level surface 10 to 15 ft lower than the older Pleistocene Prairie/Beaumont surface. These fringing Deweyville surfaces can be followed for a distance of about 30 mi down the offshore Sabine Valley, but beyond that point we have only minimal data and are unsure of their presence.

The interior portions of the offshore Sabine Valley, identified as Holocene (modern) floodplain, were only minimally examined during the study. This is mainly because all of this area appeared on seismic records as a flat-to-very-uneven biogenic gas front which absorbed and attenuated the seismic signal, thus obscuring any underlying floodplain features. Vibracores that penetrated this gas front indicate that it marks the presence of extensive swamp and marsh/estuarine organic deposits laid down before this area was inundated by rising seas. Floodplain landforms such as levees and relict channels certainly exist beneath this gas front but they could not be identified in seismic records.

During the period between 6000 to 25,000 B.P. the Sabine River in the study area was a complex and dynamic riverine and, subsequently with sea level rise, a coastal estuarine ecosystem. We must assume that at any one time the area within the boundaries of the offshore Sabine Valley exhibited the range and variety of natural settings found in present-day riverine and estuarine settings. The onshore Sabine River Valley served as an analog with which to model the settings of the study area prior to marine inundation. As expected, close correlation was seen in the configuration and distribution of many of the geological features found along the lower sections of the modern Sabine River Valley near Orange, Texas, and in those interpreted for the buried river system in the offshore study area. Onshore, the Sabine River has incised an alluvial valley, ranging from 3 to 7 mi in width, into late Pleistocene Prairie/Beaumont deposits. Deweyville terrace features fringe both sides of the valley and the characteristic "giant" meander and channel scars of the Deweyville are quite evident. The Holocene or modern floodplain of the Sabine River is confined to the central portion of the valley and is characterized by the present Sabine River course as well as relict meander belts and channel segments of earlier courses of the river. This is substantially the same setting reconstructed for the offshore study area on the basis of seismic records. The geologic setting, geomorphological history, and archaeology of the modern Sabine River Valley, therefore, provided a usable, and presently essential, model for identifying and dating features observed on seismic records in the offshore study area and in assessing the proba-

bility of archaeological site occurrence. The data collected offshore demonstrated that extensive areas of buried late Pleistocene/early Holocene, landforms are preserved in the offshore study area. Many of the offshore settings identified are known, on the basis of onshore archaeological data, to be locales commonly associated with prehistoric remains. This primarily geological exercise served as a necessary prelude for our effort to locate cultural resources within the offshore study area.

Vibracores were taken at five offshore locations selected as high probability locales. One of these areas produced data that we have interpreted as evidence of archaeological remains. This was in the Sabine Pass 6 lease block, located about 10 mi offshore (Figure 1). This area is situated on the eastern side of the former Sabine River Valley and includes a portion of Deweyville floodplain and two relict Deweyville channels. Figure 2 presents a plan view of the area derived from the seismic records. Contour lines measure ft below the present seafloor to the identified Deweyville surface. The track of the seismic survey vessel and the vibracore locations are also shown.

Figure 3 presents our geological interpretation of an east-west line of vibracores taken at this location. This section extends across the southern tributary stream into the main Sabine River Valley to the northwest. Basal deposits consist of Deweyville terrace clays and, in the stream and the Sabine Valley, freshwater organic deposits laid down prior to marine inundation of this area. Immediately above these organic deposits is a silty clay facies interpreted as river mouth deposition. Blanketing this deposit is a thin stratum of sandy-to-silty clay that is heavily burrowed and contains numerous shells of the brackish-water clam *Rangia cuneata*. Foraminifera species in this deposit indicate moderate salinities. This facies was probably formed with the initial expansion of estuarine systems into the area. This blanketing, disturbed zone was noted in most of the vibracores taken during this study and is critical in marking the boundary between marine conditions (above) and pre-inundation conditions (below). Archaeological materials are expected to be found primarily within or beneath this deposit.

Above this boundary zone is a massive deposit of gray clay which represents bay/estuarine fill (Figure 3). The homogeneity of this deposit suggests relatively rapid sedimentation. The uppermost stratum in the section consists of heavily burrowed clay containing varieties of marine shell. This represents modern open gulf seafloor deposits.

Deposits of archaeological interest at this location included a thin, highly organic feature which rested atop the Deweyville terrace bordering the filled stream. This deposit was encountered in Cores 2-A, 2-B, and 2-C and is shown as a thin black stratum above the Deweyville terrace deposits in Figure 3. This feature lies immediately below the boundary zone mentioned above and appears to be largely intact and undisturbed by marine inundation. Pollen samples from this deposit contain high percentages of grasses and a diversity of arboreal types, suggesting an upland/swamp interface. Analysis of vibracore samples produced large quantities of charred wood and vegetation, nut hulls, seeds, fish scales, and bone. Much of the bone is carbonized and some is definitely calcined. In addition to fish bone are fragments from reptiles, birds, and small mammals. The quantity of bone fragments is extremely high; some of the samples produced projected counts of over 700 fragments of bone per kg of sample. The vibracores indicated that the bone concentration covered a relatively small area of about 100 ft across. The concentration and variety of bone in this

deposit were far greater than in any other area examined. Radiocarbon dates from this location suggest that these organic deposits date to around 8800 B.P.

The critical question, of course, is whether these organic deposits represent cultural remains. In the very small core samples collected, we did not anticipate finding an identifiable artifact. Rather, it is the sedimentary character and content of the deposit that are most likely to be useful in making this assessment. The organic deposits exhibit a number of characteristics in content, configuration, and location which are consistent with those of known archaeological deposits, yet are quite different from those of natural sediments (Coleman 1966; Gagliano et al. 1982). Bone concentrations can occur in natural settings; however, the variety and types found in the Block 6 area are not anticipated naturally. Most importantly, the occurrence of both calcined and unburned bone in the deposit argues against a natural origin and suggests human activity. In addition, the location of this deposit represents an optimum setting for prehistoric site occurrence. If this locale was occupied around 8800 years ago, as is suggested by the radiocarbon dates, it

would have been at the juncture of two streams representing relict and filled Deweyville channel segments and would have been adjacent to the modern valley wall, overlooking the Sabine River floodplain and/or estuary. Numerous prehistoric archaeological sites have been found in similar settings onshore in the modern Sabine River Valley. The combined evidence suggests that these remains are, indeed, archaeological in nature. As such, they represent a unique set of archaeological data, providing clear evidence of prehistoric use of this portion of the continental shelf. Additionally, they demonstrate that early prehistoric sites can remain preserved on the continental shelf, given certain conditions.

Our study has produced a large quantity of data and increased our knowledge of a small area of the continental shelf. The methodology used, which integrates concepts and models concerning prehistoric settlement, geologic history, and landform preservation potential, should have general applicability in the study of other areas and in furthering our understanding of prehistoric human utilization of a generally unexamined area, the continental shelf.

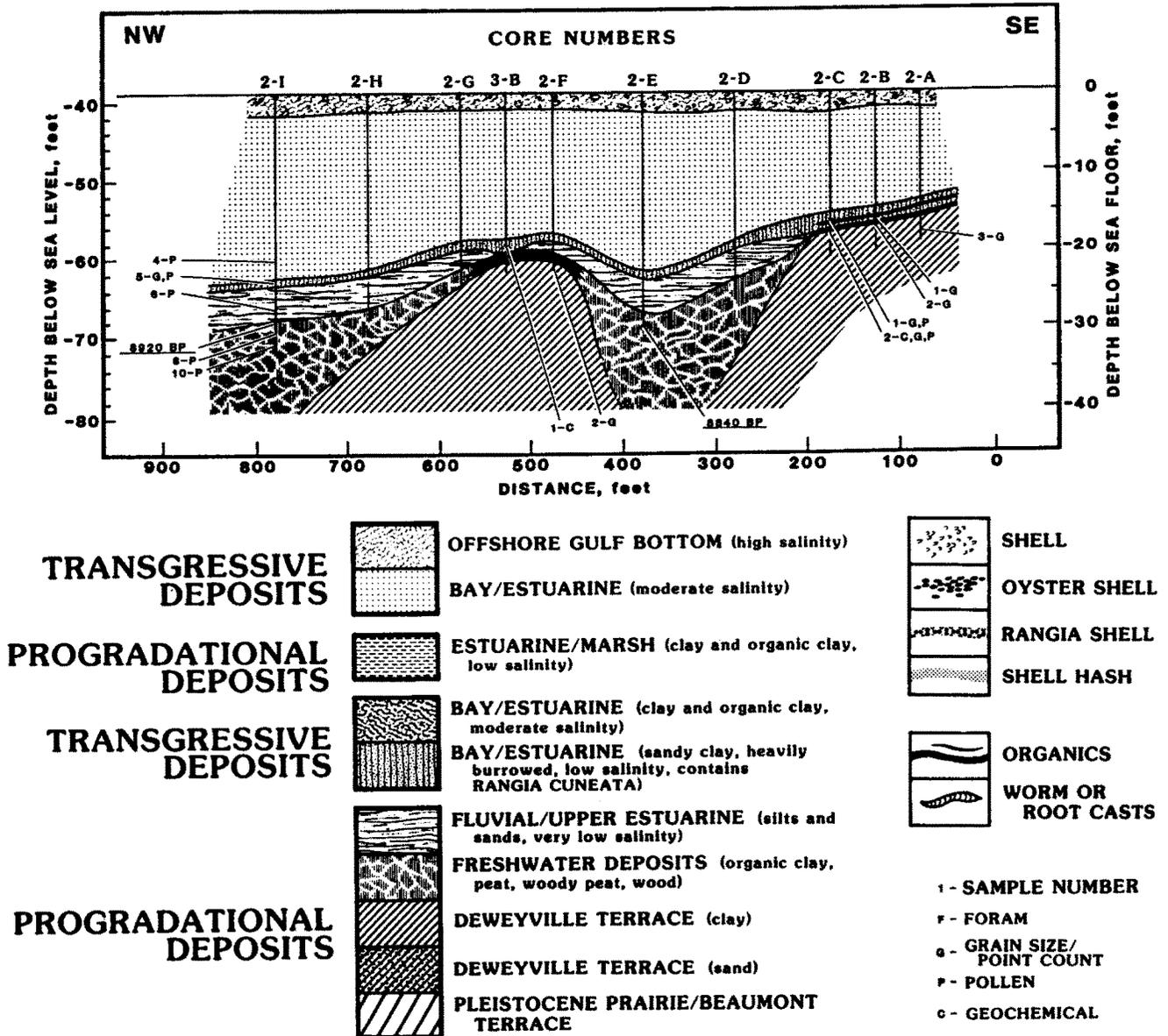


FIGURE 3. Geological cross-section in Lease Block 6 as interpreted from vibracores.

Acknowledgements

The study from which this paper was drawn was sponsored and funded by the Minerals Management Service, US Department of the Interior. Dr. Edward Friedman and Ms. Melanie Stright of the MMS we thank for the help and guidance which they provided over the course of the study. John E. Chance and Associates of Lafayette, Louisiana, collected the seismic data for this project, and McClelland Engineers of New Orleans were responsible for taking the vibracores. Rob Floyd, of John E. Chance and Associates, directed the collection of seismic data and is especially appreciated for his help and contributions. Dr. Lawrence Aten of the National Park Service is thanked for his critical and perceptive review of the results of the study. Curtis Latiolais drafted the figures. Special appreciation is extended to Dr. Sherwood M. Gagliano, Coastal Environments, Inc., whose knowledge and insights into research on the OCS really made this study possible. An earlier version of this paper was published by the Houston Archeological Society.

REFERENCES

- ALFORD, JOHN J. AND JOSEPH C. HOLMES
1985 Meander Scars as Evidence of Major Climate Change in Southwest Louisiana. *Annals of the Association of American Geographers* 75:395-403.
- ARONOW, SAUL
1971 Quaternary Geology. In *Ground-Water Resources of Chambers and Jefferson Counties, Texas*, edited by J. B. Wesselman, pp. 34-53. Report 133. Texas Water Development Board, Austin.
- ATEN, LAWRENCE E.
1983 *Indians of the Upper Texas Coast*. Academic Press, New York.
- BELKNAP, D. F. AND J. C. KRAFT
1981 Preservation Potential of Transgressive Coastal Lithosomes on the US Atlantic Shelf. *Marine Geology* 42:429-442.
- BERNARD, H. A.
1950 *Quaternary Geology of Southeast Texas*. Unpublished Ph.D. dissertation, Department of Geology, Louisiana State University, Baton Rouge.
- BERNARD, H. A. AND R. J. LEBLANC
1965 Resume of the Quaternary Geology of the Northwestern Gulf of Mexico Province. In *The Quaternary of the United States*, edited by H. E. Wright and D. G. Frey, pp. 137-185. Princeton University Press, Princeton.
- BERNARD, H. A., R. J. LEBLANC AND C. J. MAJOR
1962 Recent and Pleistocene Geology of Southeast Texas. In *Geology of the Gulf Coast and Central Texas and Guidebook of Excursions*, pp. 175-224. Houston Geologic Society, Houston.
- BERRYHILL, H. L., JR.
1980 Environmental Geology of the Pleistocene Trend Area, Northwest Gulf of Mexico. Ms. on file, US Department of the Interior, Minerals Management Service, Corpus Christi.
- COASTAL ENVIRONMENTS, INC.
1977 *Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf*. Cultural Resources Management Studies, Office of Archaeology and Historic Preservation, National Park Service, Washington, D.C.
- COLEMAN, JAMES M.
1966 *Recent Coastal Sedimentation: Central Louisiana Coast*. Technical Report 29. Coastal Studies Institute, Louisiana State University, Baton Rouge.
- CURRAY, JOSEPH R.
1960 Sediments and History of Holocene Transgression, Continental Shelf, Northwestern Gulf of Mexico. In *Recent Sediments, Northwestern Gulf of Mexico*, edited by F. P. Shepard, E. B. Phleger, and T. H. van Andel, pp. 221-226. American Association of Petroleum Geologists, Tulsa.
- GAGLIANO, SHERWOOD M., CHARLES E. PEARSON, RICHARD A. WEINSTEIN, DIANE E. WISEMAN AND CHRISTOPHER M. MCCLENDON
1982 *Sedimentary Studies of Prehistoric Archaeological Sites: Criteria for the Identification of Submerged Archaeological Sites on the Northern Gulf of Mexico Continental Shelf*. Preservation Planning Services, National Park Service, US Department of the Interior, Washington, D.C.
- GAGLIANO, SHERWOOD M. AND B. G. THOM
1967 *Deweyville Terrace, Gulf and Atlantic Coasts*. Technical Report No. 39. Coastal Studies Institute, Louisiana State University, Baton Rouge.
- KRAFT, J. C., D. F. BELKNAP AND I. KAYAN
1983 Potentials of Discovery of Human Occupation Sites on the Continental Shelves and Nearshore Coastal Zone. In *Quaternary Coastlines and Marine Archaeology*, edited by P. M. Masters and N.C. Flemming, pp. 87-120. Academic Press, New York.
- MASTERS, P. M. AND N. C. FLEMMING (EDITORS)
1983 *Quaternary Coastlines and Marine Archaeology*. Academic Press, New York.
- NELSON, HENRY F.
1968 Shoreline changes during the Recent Epoch in the Sabine-High Island Area, Gulf of Mexico. *Geological Society of America, South Central Section, Program* 1968:30-31.
- NELSON, HENRY F. AND ELLIS E. BRAY
1970 Stratigraphy and history of the Holocene sediments in the Sabine-High Island Area, Gulf of Mexico. In *Deltaic Sedimentation*, edited by J. P. Morgan, pp. 48-77. Publication No. 15. Society of Economic Paleontologists and Mineralogists, Tulsa.
- PEARSON, CHARLES E., DAVID B. KELLEY, RICHARD A. WEINSTEIN AND SHERWOOD M. GAGLIANO
1986 *Archaeological Investigations on the Outer Continental Shelf: A Study Within the Sabine River Valley, Offshore Louisiana and Texas*. Coastal Environments, Inc. Prepared for Minerals Management Service, US Department of the Interior, Reston, Virginia.
- SAUCIER, ROGER T.
1974 *Quaternary Geology of the Lower Mississippi Valley*. Research Series No. 6. Arkansas Archeological Survey, Fayetteville.

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